

CLAIMS

What is claimed is:

1. A soft gel encapsulation machine comprising:
 - a fill mechanism operable to deliver a fill material;
 - at least a pair of dies;
 - a control device operable to control operation of said fill mechanism and said dies; and
 - a serial communication ring linking said fill mechanism and said dies to said control device.

2. The soft gel encapsulation machine of claim 1, further comprising a pair of casting drums operable to form a sheet material from a flowable mass, wherein said control device is operable to control operation of said casting drums and said serial communication ring links said casting drums to said control device.

3. The soft gel encapsulation machine of claim 2, further comprising:
 - a plurality of servomotors operable to drive said fill mechanism,
 - and
 - said casting drums and said dies;
 - a plurality of servo controllers operable to control said servomotors;
 - said dies operably rotate and include sets of capsule forming cavities;
 - said fill material including an ingestible pharmaceutical.

4. The soft gel encapsulation machine of claim 1, wherein said control device is programmable.
5. The soft gel encapsulation machine of claim 1, wherein said serial communication ring includes fiber optic cables.

6. A capsule machine comprising:
 - a fill mechanism operable to deliver a fill material;
 - a first servomotor operable to mechanically independently drive said fill mechanism;
 - at least first and second dies, said first die being driven by a servomotor and said second die being mechanically linked to said first die with movement of said first die causing movement of said second die;
 - a second servomotor operable to mechanically independently drive said first die; and
 - a control device operable to control operation of said first and second servomotors.

7. The capsule machine of claim 6, further comprising:
 - first and second casting drums operable to form a sheet material from a flowable mass; and
 - third and fourth servomotors each respectively operable to drive said first and second casting drums independently of one another,
 - wherein said control device controls operation of said first, second, third and fourth servomotors independently of one another.

8. The capsule machine of claim 6, wherein the fill material is a medicine.

9. The capsule machine of claim 6, wherein said fill material mechanism includes a plurality of opposing pumps that are driven by said first servomotor.

10. The capsule machine of claim 6, wherein said control device has a virtual gear, said first and second servomotors each have respective first and second relationships to said virtual gear and said controller operates said first and second servomotors based on said first and second relationships to said virtual gear.

11. A machine comprising:

 dies operable to form soft capsules from at least two sheets of material;

 a pressure device operable to apply pressure between said dies;

 and

 a controller operable to control said dies and said pressure device, wherein said controller monitors a pressure between said dies during operation of said dies.

12. The machine of claim 11, wherein said pressure device includes a regulator operable to adjust said pressure applied between said dies and to send a signal to said controller indicative of said pressure being applied.

13. The machine of claim 11, wherein said pressure device includes a fluidic cylinder.

14. The machine of claim 11, further comprising a display device and said pressure being monitored by said controller is displayed on said display device.

15. The machine of claim 11, wherein said controller records said pressure.

16. A soft capsule machine comprising:

- (a) a wedge operable to insert a fill material between two or more sheets; and
- (b) a fill mechanism operable to supply said fill material to said wedge, said fill mechanism including:
 - (i) a pump assembly having at least one pump operable to pump said fill material to said wedge;
 - (ii) a drive mechanism operable to drive said pump assembly,

wherein said pump assembly and said drive mechanism are contained in separate housings deterring said fill material in said pump from contaminating said drive mechanism.

17. The soft capsule machine of claim 16, wherein said pump assembly includes a slide valve that controls whether said pumps are filling with said fill material or injecting said fill material and said drive mechanism imparts a reciprocating linear motion to said pumps and a reciprocating linear motion to said slide valve.

18. The soft capsule machine of claim 16, further comprising a servomotor operable to drive said drive mechanism.

19. A soft capsule machine comprising:
 - a wedge operable to insert a fill material between at least two sheets; and
 - a pump assembly operable to pump said fill material to said wedge, said pump assembly including at least one pump;
 - a catch tray positioned beneath said pump, said catch tray operable to catch fill material that leaks from said pump and direct said caught fill material to a predetermined location.
20. The soft capsule machine of claim 19, wherein said pump assembly is positioned in a housing, said housing contains a lubricant and said tray deters fill material leaking from said pump from contaminating said lubricant in said housing.
21. The soft capsule machine of claim 20, wherein said predetermined location is external to said housing.
22. The soft capsule encapsulation machine of claim 19, wherein said at least one pump is one of a plurality of opposing plunger-type pumps.

23. A soft capsule machine comprising:

 a wedge operable to insert a fill material between at least two sheets;

 a pump assembly operable to pump said fill material to said wedge, said pump assembly being driven in a reciprocating motion; and

 a lubricating pump operable to supply a lubricant to said pump assembly, said lubricating pump being driven by said reciprocating motion of said pump assembly.

24. The soft capsule machine of claim 23, wherein said pump assembly includes:

 a plurality of pumps operable to pump said fill material to said wedge assembly, said pumps being driven in a first reciprocating motion; and

 a slide valve operable to control an intake and discharge of said pumps, said slide valve being driven in a second reciprocating motion, wherein said lubricating pump is driven by one of said first and second motions and supplies a lubricant to said pump assembly.

25. The soft capsule machine of claim 24, wherein said lubricating pump is driven by said second motion.

26. The soft capsule machine of claim 23, further comprising a housing and wherein said pump assembly is located in said housing, a lubricant is in said housing, and said lubricating pump is operable to pump said lubricant in said housing to said pump assembly in response to said reciprocating motion of said pump assembly.

27. A soft capsule machine comprising:

 a wedge operable to insert a fill material between at least two sheets;

 a pump assembly operable to pump said fill material to said wedge, a first portion of said pump assembly being driven in a first reciprocating motion and second portion of said pump assembly being driven in a second reciprocating motion; and

 a drive mechanism operable to impart said first and second reciprocating motions to said pump assembly, said drive mechanism including:

- (a) a crankshaft operably rotating about an axis;
- (b) a first driving member coupled to said crankshaft;
- (c) stroke members positioned on opposite sides of said first driving member, said stroke members being spaced apart a distance that is adjustable and adjustment of said distance changing a stroke of said first motion imparted by said drive mechanism to said pump assembly; and
- (d) a second driving member between said stroke members, said second driving member being coupled to said pump assembly and imparting said first motion to said pump assembly.

28. The soft capsule machine of claim 27, wherein as said crankshaft rotates said first driving member drives said stroke members during a portion of said rotation of said crankshaft and said stroke members drive said second driving member.

29. The soft capsule machine of claim 28, wherein said portion of said rotation of said crankshaft that said stroke members are driven varies with adjustment of said distance between said stroke members.

30. The soft capsule machine of claim 27, further comprising at least one connecting member coupling said first driving member to said crankshaft.

31. The soft capsule machine of claim 27, further comprising a cam pulley operable to impart said second motion to said pump assembly with rotation of said crankshaft.

32. A capsule machine comprising:
 - a housing;
 - capsule forming dies;
 - a capsule conveyor;
 - an automatic actuator operable to drive said conveyor, said actuator being located in said housing; and
 - a connector coupling said conveyor to said actuator, said connector allowing said conveyor to be uncoupled from said actuator and separated from said housing while said actuator remains located in said housing.

33. The capsule machine of claim 32, wherein said actuator is a motor.

34. A capsule machine comprising:

 a first moveable member;

 a first servomotor operable to mechanically independently drive said first moveable member; and

 a control device operable to control operation of said first servomotor, said control device having a virtual gear,

 wherein said first servomotor has a first relationship with said virtual gear and said controller operates said first servomotor based on said first relationship.

35. The capsule machine of claim 34, further comprising:

 a second moveable member; and

 a second servomotor operable to mechanically independently drive said second moveable member, said second servomotor having a second relationship with said virtual gear,

 wherein said controller operates said second servomotor based on said second relationship.

36. The capsule machine of claim 35, wherein said first moveable member is a fill mechanism and said second moveable member is at least one die.

37. The capsule machine of claim 34, wherein said first relationship can be changed.

38. A method of operating a soft capsule machine comprising:

- (a) electronically controlling operation of the machine based upon a first set of relationships between components of the machine; and
- (b) allowing a user of the machine to alter the first set of relationships between a characteristic of dies on the machine and a fill mechanism during production of capsules with the machine.

39. The method of claim 38, wherein (b) includes electronically altering said first set of relationships.

40. The method of claim 38, wherein (b) includes limiting an ability of said user to alter said first set of relationships to a limited range.

41. The method of claim 38, wherein said characteristic is a movement of said dies and said first set of relationships is a synchronization between said die movement and said fill mechanism.

42. A method of operating a capsule making system, the method comprising:

- (a) controlling operation of the system with an electronic controller;
- (b) establishing relationships between components of the system and a virtual gear in said controller; and
- (c) automatically operating the system based on said relationships to said virtual gear.

43. The method of claim 42, wherein step (c) includes adjusting an operation of one of the components of the system and step (a) includes electronically altering operation of the other components based upon said relationships to said virtual gear.

44. The method of claim 43, wherein step (c) includes adjusting an operation of one of the components of the system while the system is operating and step (a) includes electronically altering operation of the other components while the system is operating based upon said relationships to said virtual gear.

45. The method of claim 42, wherein the system is a soft gel encapsulation system and step (b) includes establishing relationships between dies on the system and said virtual gear and between a fill material supply mechanism on the system and said virtual gear.

46. The method of claim 45, wherein step (b) includes establishing relationships between each casting drum on the system and said virtual gear.

47. The method of claim 42, wherein step (b) includes establishing a number of counts for one revolution of said virtual gear and establishing a number of counts for components of the system for each revolution of said virtual gear.

48. The method of claim 42, wherein step (a) includes controlling operation of the system with a programmable logic controller.

49. A method of operating a soft capsule machine, the method comprising:

- (a) controlling operation of the machine with an electronic controller based upon programmed relationships between components of the machine;
- (b) operating the machine and producing soft capsules;
- (c) allowing dynamic alteration of a die characteristic of dies on the machine during operation of the machine; and
- (d) altering operation of other components of the machine during operation of the machine based upon said die characteristic.

50. The method of claim 49, wherein step (d) includes altering operation of a fill supply device and casting drums on the machine.

51. The method of claim 49, wherein said die characteristic is movement of said dies.

52. A method of operating a capsule forming system having an electronic controller and a machine with components, the method comprising:

- (a) controlling operation of the system with the electronic controller; and
- (b) allowing the system to be operated with and without the controller implementing programmed relationships between the components.

53. The method of claim 52, further comprising allowing a user of the system to selectively operate individual components of the machine when said programmed relationships are not implemented by the controller.

54. The method of claim 53, wherein the system is a soft capsule system and said user is allowed to independently selectively operate dies, casting drums and a fill material supply mechanism in the system when said programmed relationships are not implemented by the controller.

55. The method of claim 52, wherein step (b) includes allowing a user of the system to select whether the controller implements said programmed relationships between the components during operation of the system.

56. A method of operating a soft encapsulation machine comprising:

- (a) producing soft capsules with the machine; and
- (b) automatically monitoring a die pressure during operation of the machine.

57. The method of claim 56, further comprising controlling operation of the machine with an electronic controller and step (b) is automatically performed by said controller.

58. The method of claim 57, further comprising allowing said die pressure to be altered by said controller during operation of the machine.

59. The method of claim 58, wherein said controller alters said die pressure as a result of a user of the machine requesting said alteration.

60. The method of claim 56, further comprising automatically altering a machine characteristic, in real time, based on a closed loop signal transmitted to said controller based on the die pressure.

61. The method of claim 56, wherein step (b) includes recording said die pressure.